NEW METHOD FOR COMPUTING THE MOVING AVERAGE.

By Willford I. King, Ph.D., *University of Wisconsin.*

Ability to readily use modern statistical methods has come to be an almost essential prerequisite to original research in the fields of economics and sociology. These sciences both deal largely with historical data. In studying the oscillations of historical variables it is nearly always necessary to compare them with some kind of a trend, and no other method of locating the trend is so generally applicable as the use of the moving average.

The usual methods of computing the moving average are satisfactory enough when the number of items in each group is small, but when a large group is used the labor involved becomes so great and the opportunities for error are so numerous that statisticians have been discouraged from employing this most useful tool. By the following method, the moving average can be computed with little extra work, even though the number of items in the group is largely increased. Each operation is checked for the detection of errors. An adding-machine is evidently a prime necessity if moving averages are to be calculated in this manner.

The method is believed to be original, though it is so simple that it is entirely possible that many other statisticians are in the habit of using it. The writer has found it convenient and practical and the students in his classes have had little difficulty in putting the device into practice.

Method for Computing the Moving Average.

1. Determine upon the correct number of items constituting one wave-length.

2. By aid of the adding-machine, summate the items constituting the first wave-length; *e. g.*, if there are seven items in one wave-length, add the first seven items, sub-totalling at the close. Continue adding, one by one, the succeeding items

of the variable, sub-totalling after *each* item is inserted. This is shown in Column I of the illustrative table.

3. Next, begin by inserting the first item of the variable in the adding-machine. Sub-total. Add the succeeding items of the variable, sub-totalling after *each* item. The spacing on the adding-machine slip must be identical with that obtained in the operation recorded in paragraph 2. The final result is illustrated in Column II.

4. Shift the second adding-machine slip downward until the first item thereon falls opposite the first item of the *second* wave-length in the first column. This is shown in Column II of the illustrative table where the *first* item is placed opposite the *eighth* item in Column I. With the adding-machine slips in this position, paste the second to the first.

5. At the head of a third column and directly to the right of its original position, enter the first sub-total of Column I. Now subtract each sub-total in the second column from the adjacent sub-total in the first column and enter the remainders immediately to the right in the third column. That part of Column II which extends below Column I is discarded.

6. Add each sub-total in Column II to the adjacent quantity in Column III. The sums, if correct, check with the sub-totals in Column I.

7. Divide each of the remainders in the third column by the number of items composing one group or wave. The quotients are the items of the moving-average. The date for the first of these items corresponds to the date of the middle item of the first wave-length in the original variable. For example, in Column I of the illustrative table, the date of the fourth or middle item of the first wave is 1893, which, therefore, is likewise the date of the first item in Column IV.

8. Check the mathematical accuracy of the last operation by summating Column IV, multiplying the sum by the number of items in one wave-length, and comparing with the sum of Column III. In case of discrepancy, the columns may be divided by horizontal lines into segments and each segment may be separately checked in the above manner until the location of the error is discovered.

AN ILLUSTRATION OF THE COMPUTATION OF A SEVEN-YEAR MOVING AVERAGE BY THE NEW PROCESS

Column I		Column II		Column III		Column IV
Pig Iron Production in the United States.		Pig Iron Production in the United States.		Column I—Column II		Moving Average.
Year.	Thousands of Tons.	Year.	Thousands of Tons.	Year.	Remainders.	Remainders ÷ Seven.
1890	*9,203*					
1891	*8,280*					
1892	*9,157*					
1893	*7,125*					
1894	*6,658*					
1895	*9,446*					
1896	*8,623*					
	58,492			1893	**58,492**	**8,356**
1897	*9,653*	1890	*9,203*			
	68,145		**9,203**	1894	**58,942**	**8,420**
1898	*11,774*	1891	*8,280*			
	79,919		**17,483**	1895	**62,436**	**8,919**
1899	*13,621*	1892	*9,157*			
	93,540		**26,640**	1896	**66,900**	**9,557**
1900	*13,789*	1893	*7,125*			
	107,329		**33,765**	1897	**73,564**	**10,509**
1901	*15,878*	1894	*6,658*			
	123,207		**40,423**	1898	**82,784**	**11,826**
1902	*17,821*	1895	*9,446*			
	141,028		**49,869**	1899	**91,159**	**13,023**
1903	*18,009*	1896	*8,623*			
	159,037		**58,492**	1900	**100,545**	**14,364**
1904	*16,497*	1897	*9,653*			
	175,534		**68,145**	1901	**107,389**	**15,341**
1905	*22,992*	1898	*11,774*			
	198,526		**79,919**	1902	**118,607**	**16,944**
1906	*25,307*	1899	*13,621*			
	223,833		**93,540**	1903	**130,293**	**18,613**
1907	*25,781*	1900	*13,789*			
	249,614		**107,329**	1904	**142,285**	**20,326**
1908	*15,936*	1901	*15,878*			
	265,550		**123,207**	1905	**142,343**	**20,335**
1909	*25,795*	1902	*17,821*			
	291,345		**141,028**	1906	**150,317**	**21,474**
1910	*27,304*	1903	*18,009*			
	318,649		**159,037**	1907	**159,612**	**22,802**
1911	*23,650*	1904	*16,497*			
	342,299		**175,534**	1908	**166,765**	**23,824**
1912	*29,727*	1905	*22,992*			
	372,026		**198,526**	1909	**173,500**	**24,786**
1913	*30,966*	1906	*25,307*			
	402,992		**223,833**	1910	**179,159**	**25,594**
1914	*23,332*	1907	*25,781*			
	426,324		**249,614**	1911	**176,710**	**25,244**
				Total	**2,241,802**	**320,257**